



Docket No.: R2184.0052/P052-A  
(PATENT)

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7/2/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:  
Naoto JIKUTANI, et al.

Application No.: 09/391,472

Group Art Unit: 1765

Filed: September 8, 1999

Examiner: Robert Kunemund

For: LASER DIODE HAVING AN ACTIVE  
LAYER CONTAINING N AND OPERABLE  
IN A 0.6UM WAVELENGTH BAND

AMENDMENT

Commissioner for Patents  
Washington, DC 20231

Dear Sir:

In response to the Office Action dated December 19, 2001 (Paper No. 8),  
please amend the above-identified U.S. Patent application as follows:

In the Abstract of the Disclosure:

Please amend the abstract to read as follows:

An optical semiconductor device operable in a 0.6  $\mu\text{m}$  band includes an active  
layer of GaInNP sandwiched by a pair of GaInP layers each having a thickness of about 2  
molecular layers or less.

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In the Written Description:

Please amend the written description to read as follows:

Page 93, line 3, through page 94, line 11:

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After such an exposure of the GaAs layer 1904 to the atmosphere containing N, the growth of the GaInNAs layer 1905 is conducted on the foregoing modified surface 1908 by supplying TMG, TMI, DMHy and AsH<sub>3</sub> respectively as the source materials of Ga, In, N and As. As noted previously, the temperature of the epitaxial growth for the GaInNAs layer 1905 is set to about 600°C, wherein it should be noted that the N content in the layer 1905 is increased when the substrate temperature is reduced or the supply rate of DMHy is increased, or the deposition rate is increased. When the deposition temperature is high, the group V elements, particularly N, escape easily from the deposited epitaxial layer. Further, it should be noted that the foregoing epitaxial growth of the GaInNAs layer 1905 is restricted by the bottle-neck process of supplying of the group III elements. Thus, whenever the supply of TMG and TMI is started, the growth of the GaInNAs layer 1905 occurs on the modified surface 1908 of the GaAs layer 1904. As the surface 1908, on which the growth of the GaInNAs layer 1905 occurs, already has the composition of GaNAs, the growth of the GaInNAs layer 1905 occurs without forming defects at the interface between the layer 1904 and layer 1905, and the GaInNAs layer 1905 is grown with substantially free from defects.

In the foregoing experiments, the process of modifying the surface 1908 of the GaAs layer 1904 was conducted by exposing the surface of the GaAs layer 1904 to the atmosphere containing N for about 30 seconds, wherein the atmosphere used for the